

09/830 920 #3

FORM PTO-1390 (REV 10-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEYS DOCKET NUMBER: 0819-551	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371					
INTERNATIONAL APPLICATION NO. PCT/JP00/06177		INTERNATIONAL FILING DATE: September 8, 2000		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/830,920	
PRIORITY DATE CLAIMED September 10, 1999					
TITLE OF INVENTION STREAM CONVERTING METHOD AND APPARATUS THEREOF, AND STREAM RECORDING METHOD AND APPARATUS THEREOF					
APPLICANT(S) FOR DO/EO/US Satoshi KONDO					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> 1. <input type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input checked="" type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input type="checkbox"/> This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)). 4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (PCT Article 31). 5. <input type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> has been communicated by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)). <ol style="list-style-type: none"> a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 					
Items 11 to 16 below concern document(s) or information included:					
11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.					
12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.					
13. <input type="checkbox"/> A FIRST preliminary amendment.					
<input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.					
14. <input type="checkbox"/> A substitute specification.					
15. <input type="checkbox"/> A change of power of attorney and/or address letter.					
16. <input checked="" type="checkbox"/> Other items or information:					
Response to Notification of Missing Requirements					
Application Data Sheet					
Recordation Cover Sheet and Executed Assignment Documents					

SCANNED, #18

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.50) 09/830,920		INTERNATIONAL APPLICATION NO. PCT/JP00/06177		ATTORNEYS DOCKET NUMBER: 0819-551	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a)(1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO#1000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....\$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(3)) paid to USPTO\$710.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4).....\$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4).....\$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS	
				PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input checked="" type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(c)).				\$130.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	12 - 20 =	0	X \$18.00	\$	
Independent claims	6 - 3 =	3	X \$80.00	\$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$130.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$	
SUBTOTAL =				\$130.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$130.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$	
TOTAL FEES ENCLOSED =				\$130.00	
				Amount to be refunded:	\$
				Charged:	\$
a. <input checked="" type="checkbox"/> A check in the amount of <u>\$130.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>19-2380</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO:					
Repln. Ref: 08/02/2001 HNGUYEN 0008403100 Dkt #: 192380 Name/Number: 09830920 FC: 704 \$90.00 CR				SIGNATURE: _____ Eric J. Robinson NAME 38,285 REGISTRATION NUMBER	

09/830 920

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of)
 Satoshi KONDO) Attention: Applications Branch
 Serial No. 09/830,920)
 Filed: September 8, 2000)
 For: STREAM CONVERTING METHOD)
 AND APPARATUS THEREOF, AND)
 STREAM RECORDING METHOD)
 AND APPARATUS THEREOF)

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with
 The United States Postal Service with sufficient postage as First
 Class Mail in an envelope addressed to: Commissioner for Patents,
 Washington, D.C. 20231, on _____

RESPONSE TO NOTIFICATION OF MISSINGREQUIREMENTS UNDER 35 U.S.C. 371

Honorable Commissioner for Patents

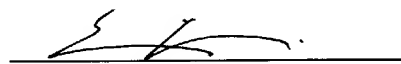
Washington, D.C. 20231

Sir:

In response to the Notification of Missing Requirement Under 35 U.S.C. 371, dated May 31, 2001, submitted herewith is an executed Declaration and Power of Attorney, and a copy of Notification of Missing Requirements Under 35 U.S.C. along with the fees under 37 CFR 1.16. (Surcharge - \$130).

The above fees are covered by the attached check in the amount of \$130.00. Should there be any additional fees required for proper filing of the attached documents, please charge Deposit Account No. 19-2380. Prompt issuance of a filing receipt is respectfully requested.

Respectfully submitted,


 Eric J. Robinson
 Reg. No. 38,285

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 8180 Greensboro Drive
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SCANNED, #18

INVENTOR INFORMATION

Rec'd PCT/PTO 31 JUL 2001

09/830920 #3

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Citizenship Country:: Japan

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APPLICATION INFORMATION

Title Line One:: STREAM CONVERTING METHOD AND APPARATUS T
Title Line Two:: HEREOF, AND STREAM RECORDING METHOD AND
Title Line Three:: APPARATUS THEREOF
Total Drawing Sheets:: 7
Formal Drawings?: Yes
Application Type:: Utility
Docket Number:: 740819-551
Secrecy Order in Parent Appl.?: No

REPRESENTATIVE INFORMATION

Representative Customer Number:: 22204
Registration Number One:: 38285
Registration Number Two:: 28290
Registration Number Three:: 45285
Registration Number Four:: 41345
Registration Number Five:: 26477

PRIOR FOREIGN APPLICATIONS

Foreign Application One:: PCT/JP00/06177
Filing Date:: 09-08-2000
Country:: PCT
Priority Claimed:: Yes
Foreign Application Two:: 11-257016
Filing Date:: 09-10-1999
Country:: Japan
Priority Claimed:: Yes

Source:: PrintEFS Version 1.0.1

SCANNED, # 18

09/830920

JC18 Rec'd PCT/PTO 03 MAY 2001

Docket: 0819-551

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase Patent Application of)
Satoshi KONDO)
International Application No. PCT/JP00/06177) Attn: US/DO/EO
International Filing Date: September 8, 2000)
For: STREAM CONVERTING METHOD AND)
APPARATUS THEREOF, AND STREAM)
RECORDING METHOD AND)
APPARATUS THEREOF) Date: May 3, 2001

PRELIMINARY AMENDMENT

Honorable Commissioner for Patents

Washington, D.C. 20231

Sir:

Please preliminarily amend the subject application as follows:

IN THE SPECIFICATION:

Please amend the specification as follows: Please note that the specification is presented below in its amended form. It is further presented as an Attachment to the Amendment whereby the amendments to the specification are outlined using the conventional method of bracketing and underlining.

Please amend the specification at page 9, lines 5, 15 and 17 as follows:

Figs. 2A-2H are schematic diagrams illustrating the operation of the stream recording apparatus shown in Fig. 1.

Figs. 6A and 6B are schematic diagrams illustrating the operation of a stream recording apparatus shown in Fig. 5.

Figs. 7A and 7B are diagrams showing a general structure of a transport stream.

Please amend page 14, second full paragraph as follows:

Upon separating the video TS packets, the bit-rate converting section 104 and the buffer section 107 are notified of the time of receipt of the head byte of each TS packet as first time of receipt T1 and second time of receipt T2, respectively.

Please amend page 25, first full paragraph as follows:

A packet selecting section 403 conducts generally three operations. The first operation is to extract PCR from the header of a TS packet. The extracted PCR as reference time information is output from the packet selecting section 403 to a reference time producing section 406. The reference time producing section 406 produces reference time ST using the PCR received from the packet selecting section 403. The produced reference time ST is output to a system control section 402.

0930930.073101

REMARKS

The specification has been amended to correct minor informalities in the specification.

Examination on the merits is requested.

Respectfully submitted,



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0986930-07101

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please amend the specification at page 9, lines 5, 15 and 17 as follows:

[Fig. 2 is a schematic diagram] Figs. 2A-2H are schematic diagrams illustrating the operation of the stream recording apparatus shown in Fig. 1.

[Fig. 6 is a schematic diagram] Figs. 6A and 6B are schematic diagrams illustrating the operation of a stream recording apparatus shown in Fig. 5.

[Fig. 7 is a diagram] Figs. 7A and 7B are diagrams showing a general structure of a transport stream.

Please amend page 14, second full paragraph as follows:

Upon separating the video TS packets, the bit-rate converting section 104 and the buffer section [123] 107 are notified of the time of receipt of the head byte of each TS packet as first time of receipt T1 and second time of receipt T2, respectively.

Please amend page 25, first full paragraph as follows:

A packet selecting section 403 conducts generally three operations. The first operation is to extract PCR from the header of a TS packet. The extracted PCR as reference time information is output from the packet selecting section 403 to a reference time producing section 406. The reference time producing section 406 produces reference time ST using the PCR received from the packet [separating] selecting section 403. The produced reference time ST is output to a system control section 402.

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Docket: 0819-551

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase Patent Application of)
Satoshi KONDO)
International Application No. PCT/JP00/06177) Attn: US/DO/EO
International Filing Date: September 8, 2000)
For: STREAM CONVERTING METHOD AND)
APPARATUS THEREOF, AND STREAM)
RECORDING METHOD AND)
APPARATUS THEREOF) Date: May 3, 2001

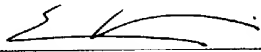
REQUEST FOR CORRECTED FORMAL DRAWING

Honorable Commissioner for Patents
Washington, D.C. 20231

Sir:

Submitted herewith is a corrected Figure 5 showing changes in red. It is hereby requested that this drawing correction be made of record in the above-identified application. Also submitted herewith is a clean copy of this corrected figure to facilitate publication of this application.

Respectfully submitted,


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FIG. 5

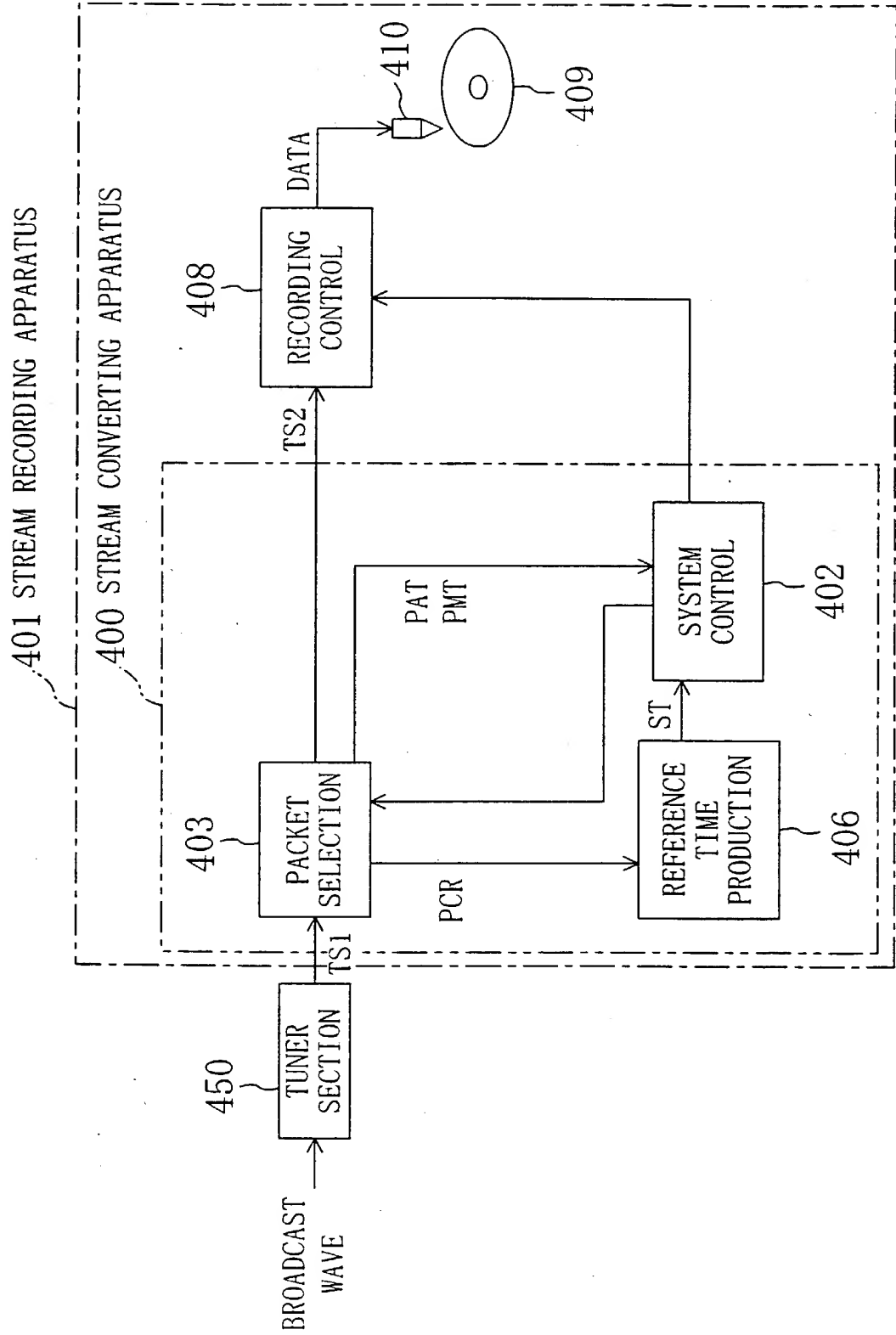
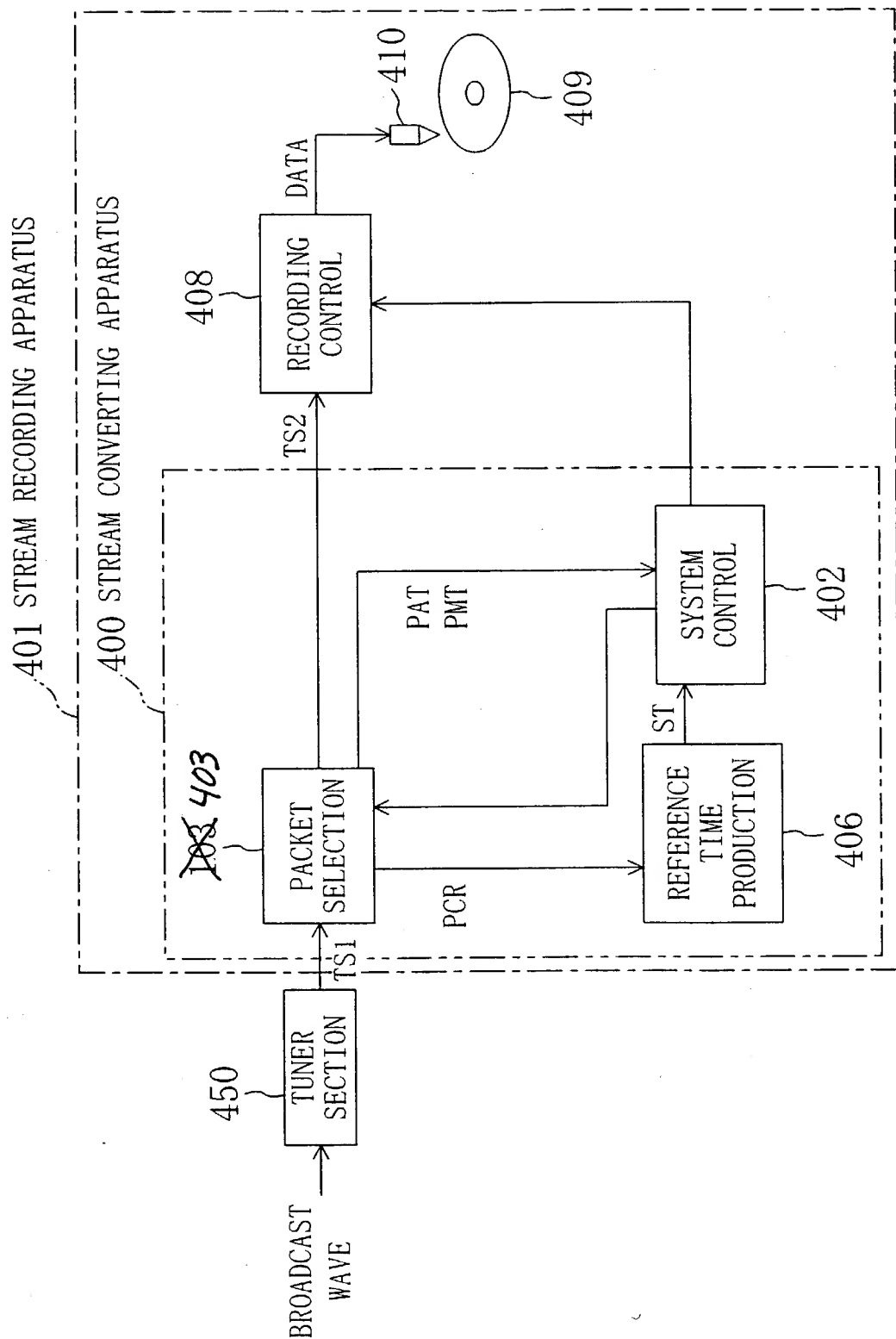


FIG. 5



DESCRIPTION**STREAM CONVERTING METHOD AND APPARATUS THEREOF, AND
STREAM RECORDING METHOD AND APPARATUS THEREOF**

5

TECHNICAL FIELD

The present invention relates to technology for converting the bit rate of a digital stream supplied from digital broadcasting, a digital interface or the like, and technology for recording the digital stream having the rate converted onto a medium.

BACKGROUND ART

Recently, digital broadcasting has started in satellite broadcasting and terrestrial broadcasting. In the digital broadcasting, data such as compressed, encoded video data (picture data), audio data (sound data) and other management data corresponding to a plurality of channels are generally multiplexed for transmission. The video data and audio data are generally compressed and encoded according to the MPEG1 or MPEG2 method. An MPEG2 transport stream (TS: Transport Stream; hereinafter, simply referred to as "TS" as appropriate) is generally used for multiplexing. A standard for transmitting such a transport stream from a set-top box to another equipment through a digital interface such as

IEEE1394 has also been determined.

FIG. 7 is a diagram showing a general structure of the transport stream. As shown in FIG. 7, a transport stream is formed from 188-byte packets (TS packets). Each TS packet is divided into a header portion and a data portion. The header portion includes reference time information called PCR (Program Clock Reference) and the like. On the other hand, the data portion includes one type of data out of general data such as video data, audio data, program specific information (PSI) data and additional data.

As shown in FIG. 7(a), a bitstream of the video data, audio data or additional data is called an elementary stream. The elementary stream is packetized by a prescribed unit into PES (Packetized Elementary Stream) packets. The PES packet is formed from a PES packet header and PES packet data that forms a part of the elementary stream. The PES packet header includes decoding time (DTS), display time (PTS) and the like of the elementary stream. The PES packet is packetized by a prescribed unit into TS packets each having a TS packet header added thereto.

On the other hand, as shown in FIG. 7(b), the program specific information data is called a PSI section. The PSI section is formed from a PSI section header and a PSI table. The PSI section is packetized by a prescribed unit into TS packets each having a TS packet header added thereto.

It is possible to reproduce synchronized picture, audio and the like by decoding the transport stream as shown in FIG. 7 with reference to the header information and management data in the order of arrival.

5 An apparatus for recording such a transport stream onto a magnetic tape is disclosed in Japanese Laid-Open Publication No. 8-273305. The transport stream cannot be recorded on an analog video tape recorder and the like. Therefore, the aforementioned publication proposes a method
10 for recording on the magnetic tape an input transport stream or a stream corresponding to a single channel that is selected from the transport stream.

PROBLEMS

15 However, the prior art has the following problems.

The aforementioned method directly records an input transport stream or a stream corresponding to a single channel that is selected from the transport stream. Since a magnetic tape generally has a very large capacity, long
20 recording time can be ensured even if the stream is thus directly recorded thereon.

However, a recording medium having a smaller capacity than that of the magnetic tape, e.g., an optical disk, has very short recording time when the stream is recorded thereon
25 by the aforementioned method, causing a practical problem.

For example, a typical high-capacity recording optical disk, DVD-RAM, has a capacity of 2.6 GB. A stream having a bit rate of 6 Mbps can be recorded on the DVD-RAM at most only for about one hour.

5 On the other hand, in a current analog VTR, recording for two to three hours is possible even in the standard mode. A movie, a sports program and the like normally last for about two hours. In view of the above, a recording optical disk such as DVD-RAM may not be utilized very much as a
10 broadcast recording medium when a stream is recorded thereon using the conventional method.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to enable, with
15 a simple structure, a stream of digital broadcasting to be recorded for a long time even on a small-capacity medium.

More specifically, according to the present invention, a stream converting method includes the steps of: separating a first transport stream (TS) into a first TS packet string
20 formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier; converting a bit rate of the first TS packet string so as to produce a third TS packet string; and multiplexing the
25 produced third TS packet string and the second TS packet

string so as to produce a second transport stream.

Preferably, the stream converting method according to the present invention includes the steps of: extracting reference time information from the first transport stream so as to produce reference time from the reference time information; determining, with reference to the reference time, time of receipt of a TS packet including a head byte of a PES packet in the first TS packet string as first time of receipt; determining, with reference to the reference time, time of receipt of a head byte of each TS packet forming the second TS packet string as second time of receipt; and delaying the reference time by a prescribed time so as to produce delayed reference time, and the packet multiplexing step includes the steps of selecting from the third TS packet string a TS packet corresponding to the first time of receipt for output as the second transport stream, when the delayed reference time matches the first time of receipt, and selecting from the second TS packet string a TS packet corresponding to the second time of receipt for output as the second transport stream, when the delayed reference time matches the second time of receipt.

More specifically, according to the present invention, a stream recording method includes the steps of: separating a first transport stream into a first TS packet string formed from TS packets that have a prescribed packet identifier and

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a second TS packet string formed from TS packets that do not have the prescribed packet identifier; converting a bit rate of the first TS packet string so as to produce a third TS packet string; multiplexing the produced third TS packet string and the second TS packet string so as to produce a second transport stream; extracting reference time information from the first transport stream, and delaying reference time represented by the reference time information by a prescribed time so as to produce delayed reference time; and determining, with reference to the delayed reference time, time of receipt of each TS packet forming the second transport stream, and recording the second transport stream together with the determined time of receipt onto a recording medium.

More specifically, according to the present invention, a stream recording method includes the steps of: selecting TS packets other than TS packets having a prescribed packet identifier from a first transport stream so as to output the selected TS packets as a second transport stream; extracting reference time information from the first transport stream so as to produce reference time from the reference time information; and determining, with reference to the reference time, time of receipt of each TS packet forming the second transport stream, and recording the second transport stream together with the determined time of receipt onto a recording

medium.

More specifically, according to the present invention, a stream converting apparatus includes: a packet separating section for separating a first transport stream into a first TS packet string formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier; a bit-rate converting section for converting a bit rate of the first TS packet string so as to produce a third TS packet string; and a packet multiplexing section for multiplexing the third TS packet string output from the bit-rate converting section and the second TS packet string output from the packet separating section so as to produce a second transport stream.

More specifically, according to the present invention, a stream recording apparatus includes: a packet separating section for separating a first transport stream into a first TS packet string formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier; a bit-rate converting section for converting a bit rate of the first TS packet string so as to produce a third TS packet string; a packet multiplexing section for multiplexing the third TS packet string output from the bit-rate converting section and the second TS packet string

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the structure of a stream recording apparatus according to a first embodiment of the present invention.

5 FIG. 2 is a schematic diagram illustrating the operation of the stream recording apparatus shown in FIG. 1.

FIG. 3 is a diagram showing the relation between PAT (Program Association Table), PMT (Program Map Table) and a stream of picture, sound and the like.

10 FIG. 4 is a block diagram showing the structure of a bit-rate converting section in the structure of FIG. 1.

FIG. 5 is a block diagram showing the structure of a stream recording apparatus according to a second embodiment of the present invention.

15 FIG. 6 is a schematic diagram illustrating the operation of a stream recording apparatus shown in FIG. 5.

FIG. 7 is a diagram showing a general structure of a transport stream.

20 **BEST MODE FOR CARRYING OUT THE INVENTION**

(First Embodiment)

FIG. 1 is a block diagram showing the structure of a stream recording apparatus according to the first embodiment of the present invention. In FIG. 1, the stream recording
25 apparatus 101 includes a stream converting apparatus 100, a

recording control section 108 and an optical head 110, and records an input transport stream (TS) onto an optical disk 109 as a recording medium. The stream converting apparatus 100 converts an input first transport stream TS1 into a second transport stream TS2 by conducting packet separation, bit-rate conversion and packet re-multiplexing.

In the structure of FIG. 1, a tuner section 150 is connected to the input stage of the stream recording apparatus 101. A broadcast wave input to the tuner section 150 via an antenna or the like is subjected to processing in the tuner section 150 such as demodulation of a selected transmission carrier, and is output as a first transport stream TS1.

For simplification of the description, it is herein assumed that only a stream of a single program is included in the first transport stream TS1. A "program" as used herein corresponds to, e.g., a digital broadcast program.

FIG. 2 is a schematic diagram illustrating the operation of the stream recording apparatus 101 shown in FIG. 1. Stream conversion and stream recording according to the present embodiment will now be described in conjunction with FIG. 2.

A packet separating section 103 conducts generally three operations. The first operation is to extract PCR (Program Clock Reference) from the header of a TS packet. The PCR is

not added to the header of every TS packet, but is extracted if any. The extracted PCR as reference time information is output from the packet separating section 103 to a reference time producing section 106.

5 The reference time producing section 106 produces reference time ST using the PCR received from the packet separating section 103. In the MPEG2-TS, the PCR is indicated by a value having its minimum unit corresponding to one clock of 27-MHz clocks. Accordingly, the reference time
10 producing section 106 produces 27-MHz clocks by a PLL, and counts the clocks using the PCR value, thereby producing the reference time ST. The reference time ST thus produced is output to the packet separating section 103 and a system control section 102. The reference time ST input to the
15 system control section 102 is delayed at least by a processing time required in a bit-rate converting section 104, and is then output as delayed reference time DST to the bit-rate converting section 104, a buffer section 107 and a packet multiplexing section 105.

20 The second operation of the packet separating section 103 is to obtain a PAT (Program Association Table) and a PMT (Program Map Table) from the information of a program specific information (Program Specific Information: PSI) TS packet included in the first transport stream TS1. The PAT
25 and PMT thus obtained are output from the packet separating

section 103 to the system control section 102.

The PAT and PMT are tables indicating the structure of each program multiplexed in a transport stream, and are essential for selection of a program on the receiving side.

5 Since the picture, sound and data of a plurality of programs are multiplexed in a single MPEG-TS, the receiving side must search for desired picture, sound or the like therefrom. In the MPEG-TS, an identifier called a PID (Packet Identification) is written to a packet header of each
10 transport packet. However, the value of each PID is not notified in advance to the receiving side, but instead, a program number is given by an EPG (Electric Program Guide) or the like. The PAT and PMT are intended to implement a scheme for finding the PID from the program number.

15 FIG. 3 is a diagram showing the relation between the PAT, PMT and a stream of picture, sound and the like. The PMT has a table of, e.g., a stream of picture, sound and the like included in each program (actually, a table of the PIDs). Only information of a single program is written in each PMT,
20 and the PMTs corresponding to the number of programs are present in a single transport stream. In summary, the PAT is a table of the PMTs, and has a table of the program numbers and the PIDs of the corresponding PMTs themselves. Only one sequence is present in a single transport stream.

25 The third operation of the packet separating section 103

is to separate the packets of the input first transport stream **TS1**. More specifically, the first transport stream **TS1** is separated into a first TS packet string **P1** formed from TS packets that have a prescribed packet identifier, and a
5 second TS packet string **P2** formed from TS packets that do not have the prescribed packet identifier.

It is herein assumed that video data is separated from the first transport stream **TS1**. It is also assumed that the video data has been packetized such that the data
10 corresponding to a single frame forms a single PES packet.

FIGS. 2(a) to (c) show the state of the packet separation as conducted herein. In the figures, (a) shows the first transport stream **TS1**, (b) shows the first TS packet string **P1**, and (c) shows the second TS packet string **P2**. In
15 FIGS. 2(a) to (c), the abscissa indicates time, which herein refers to the reference time **ST** produced by the reference time producing section 106. Each rectangle represents a single TS packet, wherein a rectangle denoted with "P" represents a program specific information (PSI) TS packet, a
20 rectangle with "V" represents a video TS packet, and a rectangle with "A" represents an audio TS packet. For the other TS packets as well, a TS packet having the same pattern represents a TS packet of the same type.

The system control section 102 obtains a packet
25 identifier (PID) of the video TS packets from the PMT sent

from the packet separating section 103. Then, the system control section 102 designates this PID and sends an instruction to the packet separating section 103 to separate the video TS packets from the first transport stream TS1.

5 In response to the instruction, the packet separating section 103 identifies the video TS packets from the first transport stream TS1 as shown in FIG. 2(a), and outputs the first TS packet string P1 formed from the video TS packets as shown in FIG. 2(b), and the second TS packet string P2 formed
10 from the other TS packets as shown in FIG. 2(c). More specifically, every time the packet separating section 103 finds the header of a TS packet, it checks the PID of that TS packet. If the checked PID matches the PID of the video TS packet, the packet separating section 103 separates that TS
15 packet so as to output the separated TS packets to the bit-rate converting section 104 as the first TS packet string P1. The remaining TS packets are output to the buffer section 107 as the second TS packet string P2.

Upon separating the video TS packets, the bit-rate
20 converting section 104 and the buffer section 123 are notified of the time of receipt of the head byte of each TS packet as first time of receipt T1 and second time of receipt T2, respectively.

The operation of the bit-rate converting section 104
25 will now be described. FIG. 4 is a block diagram showing the

structure of the bit-rate converting section 104. As shown in FIG. 4, the bit-rate converting section 104 includes a PES packet extracting section 301, a rate converting section 302, an output control section 303 and a time notifying section 304.

FIGS. 2(d) to (f) show the state of the bit-rate conversion as conducted herein. It is assumed that, in FIG. 2, video TS packets 211, 212, 213, 214 are TS packets each including the head data of a PES packet. In FIGS. 2(d), (e), the abscissa indicates the data amount rather than time.

The first TS packet string P1 formed from the video TS packets, which is sent from the packet separating section 103, is input to the PES packet extracting section 301. The PES packet extracting section 301 removes the TS packet headers from the first TS packet string P1 and connects the data of a plurality of TS packets together to extract a PES packet PES1. The extracted PES packet PES1 is output to the rate converting section 302. For example, in FIG. 2(d), a video PES packet 231 is produced from the video TS packets 211 and 221 to 223.

In addition, the time notifying section 304 receives as an input the time of receipt T1 of each video TS packet, which is sent from the packet separating section 103. When the PES packet extracting section 301 finds the head data of the PES packet PES1, it notifies the time notifying section

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304 thereof. Upon receiving the notification from the PES packet extracting section 301 that the head data of the PES packet PES1 was found, the time notifying section 304 outputs the time of receipt T1 of the video TS packet including that head data to the output control section 303. In the example of FIG. 2, the time at the head of the PES packet 231 is t1, which is output to the output control section 303. Similarly, time t2 as the head time of a PES packet 232, time t3 as the head time of a PES packet 233, and time t4 as the head time of a PES packet 234 are each output to the output control section 303.

The rate converting section 302 converts the bit rate of the video data for the video PES packets PES1 output from the PES packet extracting section 301. The bit-rate converting method includes a method in which a stream is directly subjected to the bit-rate conversion (e.g., high-order components of a frequency conversion coefficient are eliminated), a method in which a stream is once decoded into a video signal for re-encoding, and the like. The rate converting section 302 outputs PES packets CPES1 having the bit rate converted to the output control section 303. It should be noted that, in the case where the decoded video signal is re-encoded in the bit-rate conversion of the rate converting section 302, processing such as re-addition of a PES packet header is required in the rate converting section.

302. In FIG. 2(e), the PES packet 231 is converted into a PES packet 241 and the PES packet 232 is converted into a PES packet 242.

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The output control section 303 receives as inputs the PES packets CPES1 which are output from the rate converting section 302, the respective time of receipt of the head bytes of the PES packets PES1 which is output from the time notifying section 304, and the delayed reference time DST which is sent from the system control section 102. Then, the video PES packet CPES1 is divided into TS packets. This is conducted by dividing the video PES packet CPES1 by a prescribed data length, and adding a TS packet header thereto. For example, as shown in FIG. 2(f), the PES packet 241 is divided into TS packets 251, 252, and the PES packet 242 is divided into TS packets 254, 255, 256. Herein, a portion 253 of the TS packet 252 does not have valid data, but is stuffing data. The TS packet 256 also includes stuffing data.

When the time of receipt of the head byte of the PES packet PES1 matches the delayed reference time DST, the TS packets produced from the PES packet CPES1 output from the rate converting section 302 are output to the packet multiplexing section 105 as a third TS packet string P3. For example, if the delayed reference time DST is time t_1 , the TS packets 251, 252 produced from the PES packet 241 are output, and if the delayed reference time DST is time t_2 , the TS

packets 254, 255, 256 produced from the PES packet 242 are outputs.

On the other hand, the buffer section 107 receives as inputs the second TS packet string P2 formed from the TS packets other than the video TS packets which is output from the packet separating section 103, the time of receipt T2 of each TS packet of the second TS packet string P2 which is output from the packet separating section 103, and the delayed reference time DST which is output from the system control section 102. When the time of receipt T2 of the TS packet received from the packet separating section 103 matches the delayed reference time DST, the TS packet corresponding to that time of receipt is output to the packet multiplexing section 105. In other words, the buffer section 107 outputs the second TS packet string P2 output from the packet separating section 103 with a delay corresponding to the time added to the reference time ST by the system control section 102.

The packet multiplexing section 105 receives as inputs the third TS packet string P3 output from the bit-rate converting section 104 as shown in FIG. 2(f), and the second TS packet string P2 output from the buffer section 107 as shown in FIG. 2(c). Then, the third TS packet string P3 and the second TS packet string P2 are multiplexed. In this multiplexing, the respective time of the TS packets of the

second TS packet string P2 are made to match their respective original time of receipt. Regarding the third TS packet string P3, the time of receipt of a TS packet including the head byte of a video PES packet is made to match the original
5 time of receipt.

For example, as shown in FIG. 2(g), a TS packet 201 included in the second TS packet string P2 is multiplexed at the position of the original time of receipt, i.e., time t0, and the TS packet 251 included in the third TS packet string
10 P3 is multiplexed at the position of the time of receipt of the TS packet 211 including the head byte of the original video PES packet 231, i.e., time t1. The TS packet 252 produced from the same PES packet 231 as that of the TS packet 251 is herein multiplexed following the TS packet 251
15 (time t6). Since there is no TS packet to be multiplexed at the following time t5, this position is empty. Then, a TS packet 225 included in the second TS packet string P2 is multiplexed at the position of time t7, and the subsequent position is again empty.

20 The TS packet 254, which is located at the head of the TS packets produced from the PES packet 232, is multiplexed at the subsequent position of time t2. Following the TS packet 254, a TS packet 226 included in the second TS packet string P2 is multiplexed preferentially. Since there is no
25 TS packet other than the video TS packets after the TS packet

226, the video TS packets 255, 256 are multiplexed subsequently.

The TS packet string thus produced is output as a second transport stream **TS2** from the packet multiplexing section 105 to the recording control section 108.

The recording control section 108 receives as inputs the second transport stream **TS2** output from the packet multiplexing section 105 and the delayed reference time **DST** output from the system control section 102. The recording control section 108 determines the time of receipt of each TS packet forming the second transport stream **TS2**, and records the second transport stream **TS2** together with the determined time of receipt onto the optical disk 109 through the optical head 110. FIG. 2(h) shows an example of the data structure of data **DATA** recorded on the optical disk 109. As shown in FIG. 2(h), the empty portion in the second transport stream **TS2** is not used, but only the valid TS packets are recorded as the record data **DATA**.

As described above, in the stream conversion according to the present embodiment, TS packets having a prescribed program identifier (e.g., video TS packets) are extracted from a transport stream received from digital broadcasting or the like, and the TS packet string having the prescribed program identifier is converted into data having a low bit rate. Then, the TS packet string thus converted into the low

bit rate is re-multiplexed with the TS packets other than those having the prescribed program identifier. The TS packets having the prescribed program identifier are multiplexed such that the respective start time of the PES
5 packets matches that of the original transport stream, and the TS packets other than those having the prescribed program identifier are multiplexed such that their respective time of receipt matches their original time of receipt. Moreover, in the stream recording according to the present embodiment, the
10 stream-converted TS packet string is recorded onto a recording medium together with the time of receipt of the TS packet string.

Thus, a transport stream of digital broadcasting can be recorded for a long time even on a small-capacity medium,
15 because the transport stream having its bit rate converted into a low bit rate is recorded. Moreover, since the original time information is used for re-multiplexing, stream conversion can be realized with a simple structure. For example, since the reference time is common before and after
20 the stream conversion and the same PCR value can be used, the PCR value can be easily added to the TS packet header, eliminating the need to change the display time (PTS), decoding time (DTS) and the like that are included in the PES packet header. Moreover, since the stream is recorded
25 together with the time of receipt of each TS packet, the TS

packet string having the same timing as that upon recording can be output for reproduction.

Note that, although only the bit rate of the video data is converted into a low bit rate in the present embodiment, only the bit rate of the audio data, for example, may be converted into a low bit rate, or the bit rate of both the video data and audio data may be converted into a low bit rate.

Moreover, although only a stream of a single program is included in the transport stream in the present embodiment, a stream of a plurality of programs may be included therein.

Moreover, the bit-rate converting method of the present embodiment may either be fixed-bit-rate encoding or variable-bit-rate encoding.

Moreover, various methods are possible as a method for determining the type of data whose bit rate is to be converted or determining a bit rate in the rate conversion in the present embodiment.

The method for determining the type of data whose bit rate is to be converted includes, as a first example, a method in which only the bit rate of the video data is converted when the difference between the bit rate of an input transport stream and the bit rate to be achieved by conversion is small, and the bit rate of both the video data and audio data is converted when the difference is large. A

method for knowing the bit rate of an input transport stream includes a method in which an input bit stream is directly counted, a method using the bit rate information in the bit stream, and the like. In the case where the input transport stream has a variable bit rate, the type of data whose bit rate is to be reduced may either be determined according to its maximum bit rate or according to a change in the bit rate.

As a second example, there is a method for determining according to setting from the user. For example, in the case where the user has determined the video and audio recording quality when setting the recording or the like, the type of data whose bit rate is to be converted is determined according to the determined recording quality. Herein, the bit rate is not converted when the determined recording quality is high, and is converted when the quality is low.

The method for determining the bit rate in the rate conversion includes a method for determining it according to the content of the picture of an input transport stream. For example, for the picture that is hard to encode like sports or music programs, the rate conversion degree is reduced (i.e., the bit rate is not significantly reduced), and for the picture that is easy to encode like news, the rate conversion degree is increased (i.e., the bit rate is significantly reduced). The method for knowing the content of the picture includes a method for searching it from the

program content described in the PSI, a method for knowing it by obtaining the degree of difficulty in encoding from the relation between the amount of bits produced and the quantization scale of a video stream, and the like.

5 (Second Embodiment)

FIG. 5 is a block diagram showing the structure of a stream recording apparatus according to the second embodiment of the present invention. In FIG. 5, the stream recording apparatus 401 includes a stream converting apparatus 400, a recording control section 408 and an optical head 410, and records an input transport stream onto an optical disk 409 as a recording medium. The stream converting apparatus 400 converts an input first transport stream TS1 into a second transport stream TS2 by packet selection.

10 In the structure of FIG. 5, a tuner section 450 is connected to the input stage of the stream recording apparatus 401. A broadcast wave input to the tuner section 450 via an antenna or the like is subjected to processing in the tuner section 450 such as demodulation of a selected transmission carrier, and is output as a first transport stream TS1.

For simplification of the description, it is herein assumed that only a stream of a single program is included in the first transport stream TS1.

25 FIG. 6 is a schematic diagram illustrating the operation

of the stream recording apparatus 401 shown in FIG. 5. Stream conversion and stream recording according to the present embodiment will now be described in conjunction with FIG. 6.

5 A packet selecting section 403 conducts generally three operations. The first operation is to extract PCR from the header of a TS packet. The extracted PCR as reference time information is output from the packet selecting section 403 to a reference time producing section 406. The reference
10 time producing section 406 produces reference time ST using the PCR received from the packet separating section 403. The produced reference time ST is output to a system control section 402.

The second operation of the packet selecting section 403
15 is to obtain PAT and PMT from the information of a program specific information (PSI) TS packet included in the first transport stream TS1. The PAT and PMT thus obtained are output from the packet selecting section 403 to the system control section 402.

20 The third operation of the packet selecting section 403 is to select and remove a specific type of TS packets from the input first transport stream TS1. In other words, TS packets other than those having a prescribed packet identifier are selected from the first transport stream TS1,
25 and the selected TS packets are output as a second transport

stream TS2.

It is herein assumed that packets of additional data (data for data broadcasting, text data, script and the like) are selected and removed from the first transport stream TS1.

FIGS. 6(a), (b) show the state of the packet selection as conducted herein. In the figures, (a) shows the first transport stream TS1, and (b) shows the second transport stream TS2. In FIGS. 6(a), (b), the abscissa indicates time, which herein refers to the reference time ST produced by the reference time producing section 406. Each rectangle represents a single TS packet, wherein a rectangle denoted with "P" represents a program specific information (PSI) TS packet, a rectangle with "V" represents a video TS packet, and a rectangle with "A" represents an audio TS packet. A rectangle without any character indicates an additional data TS packet to be removed herein. For the other TS packets as well, a TS packet having the same pattern represents a TS packet of the same type.

The system control section 402 designates the PID of additional data TS packets that is obtained from the PMT included in the system control section 402, and sends an instruction to the packet selecting section 403 to separate the additional data TS packets from the first transport stream TS1.

In response to this instruction, every time the packet

selecting section 403 finds the header of a TS packet, it checks the PID of that TS packet. Then, if that PID matches the PID of the additional data TS packets that is designated by the system control section 402, the packet selecting section 403 separates that TS packet. In other words, the packet selecting section 403 separates the additional data TS packets from the first transport stream TS1 as shown in FIG. 6(a), and outputs the TS packets other than the additional data TS packets as shown in FIG. 6(b) as a second transport stream TS2.

The recording control section 408 receives as inputs the second transport stream TS2 output from the packet selecting section 403 and the reference time ST output from the system control section 402. Then, the recording control section 408 determines the time of receipt of each TS packet forming the second transport stream TS2, and records as record data DATA the second transport stream TS2 together with the determined time of receipt onto the optical disk 409 through the optical head 410. At this time, the empty portion in the second transport stream TS2 resulting from separation of the additional data TS packets is not recorded.

Thus, in the stream recording according to the present embodiment, TS packets having a prescribed program identifier (e.g., additional data TS packets) are separated from a transport stream received from broadcasting or the like so as

to produce a TS packet string formed from the TS packets other than those having the prescribed program identifier. Then, the TS packet string thus produced is recorded onto a recording medium together with the time of receipt of the TS packet string.

Accordingly, a stream of digital broadcasting can be recorded for a long time even on a small-capacity medium, because the transport stream having its bit rate converted into a low bit rate is recorded. Moreover, in the case where the TS packets to be separated are the additional data TS packets, the separated data is not essential for reproduction of the stream, and therefore, the recorded stream is not rendered irreproducible upon watching the program. Moreover, since the stream is recorded together with the time of receipt of each TS packet, the TS packet string having the same timing as that upon recording can be output for reproduction.

Note that, although each of the above embodiments has been described for the case of converting and recording a transport stream received from broadcasting, a transport stream supplied from another input form, e.g., a digital interface, may alternatively be converted and recorded.

Moreover, although each of the above embodiments has been described for the case of using the optical disk as a recording medium, another recording medium such as a magnetic

disk and a magnetic tape may alternatively be used.

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WHAT IS CLAIMED IS:

1. A stream converting method, characterized in that it comprises the steps of:

separating a first transport stream (TS) into a first TS
5 packet string formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier;

converting a bit rate of the first TS packet string so as to produce a third TS packet string; and

10 multiplexing the produced third TS packet string and the second TS packet string so as to produce a second transport stream.

2. The stream converting method according to claim 1,
15 characterized in that the prescribed packet identifier is a packet identifier of at least one of video data and audio data.

3. The stream converting method according to claim 1,
20 characterized in that it comprises the steps of:

extracting reference time information from the first transport stream so as to produce reference time from the reference time information;

determining, with reference to the reference time, time
25 of receipt of a TS packet including a head byte of a PES

packet in the first TS packet string as first time of receipt;

determining, with reference to the reference time, time of receipt of a head byte of each TS packet forming the
5 second TS packet string as second time of receipt; and

delaying the reference time by a prescribed time so as to produce delayed reference time, and in that the packet multiplexing step includes the steps of

selecting from the third TS packet string a TS packet
10 corresponding to the first time of receipt for output as the second transport stream, when the delayed reference time matches the first time of receipt, and

selecting from the second TS packet string a TS packet corresponding to the second time of receipt for output as the
15 second transport stream, when the delayed reference time matches the second time of receipt.

4. A stream recording method, characterized in that it comprises the steps of:

20 separating a first transport stream into a first TS packet string formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier;

converting a bit rate of the first TS packet string so
25 as to produce a third TS packet string;

multiplexing the produced third TS packet string and the second TS packet string so as to produce a second transport stream;

extracting reference time information from the first
5 transport stream, and delaying reference time represented by the reference time information by a prescribed time so as to produce delayed reference time; and

determining, with reference to the delayed reference time, time of receipt of each TS packet forming the second
10 transport stream, and recording the second transport stream together with the determined time of receipt onto a recording medium.

5. A stream recording method, characterized in that it
15 comprises the steps of:

selecting TS packets other than TS packets having a prescribed packet identifier from a first transport stream so as to output the selected TS packets as a second transport stream;

20 extracting reference time information from the first transport stream so as to produce reference time from the reference time information; and

determining, with reference to the reference time, time of receipt of each TS packet forming the second transport
25 stream, and recording the second transport stream together

with the determined time of receipt onto a recording medium.

6. The stream recording method according to claim 4 or 5, characterized in that the prescribed packet identifier is a packet identifier of at least one of video data and audio data.

7. The stream recording method according to claim 4 or 5, characterized in that the recording medium is an optical disk.

8. A stream converting apparatus, characterized in that it comprises:

a packet separating section for separating a first transport stream into a first TS packet string formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier;

a bit-rate converting section for converting a bit rate of the first TS packet string so as to produce a third TS packet string; and

a packet multiplexing section for multiplexing the third TS packet string output from the bit-rate converting section and the second TS packet string output from the packet separating section so as to produce a second transport stream.

9. A stream recording apparatus, characterized in that it comprises:

5 a packet separating section for separating a first transport stream into a first TS packet string formed from TS packets that have a prescribed packet identifier and a second TS packet string formed from TS packets that do not have the prescribed packet identifier;

10 a bit-rate converting section for converting a bit rate of the first TS packet string so as to produce a third TS packet string;

15 a packet multiplexing section for multiplexing the third TS packet string output from the bit-rate converting section and the second TS packet string output from the packet separating section so as to produce a second transport stream;

a means for extracting reference time information from the first transport stream, and delaying reference time represented by the reference time information by a prescribed time so as to produce delayed reference time; and

20 a recording control section for determining, with reference to the delayed reference time, time of receipt of each TS packet forming the second transport stream, and recording the second transport stream together with the determined time of receipt onto a recording medium.

25

10. A stream recording apparatus, characterized in that it comprises:

a packet selecting section for selecting TS packets other than TS packets having a prescribed packet identifier from a first transport stream so as to output the selected TS packets as a second transport stream;

a means for extracting reference time information from the first transport stream so as to produce reference time from the reference time information; and

10 a recording control section for determining, with reference to the reference time, time of receipt of each TS packet forming the second transport stream, and recording the second transport stream together with the determined time of receipt onto a recording medium.

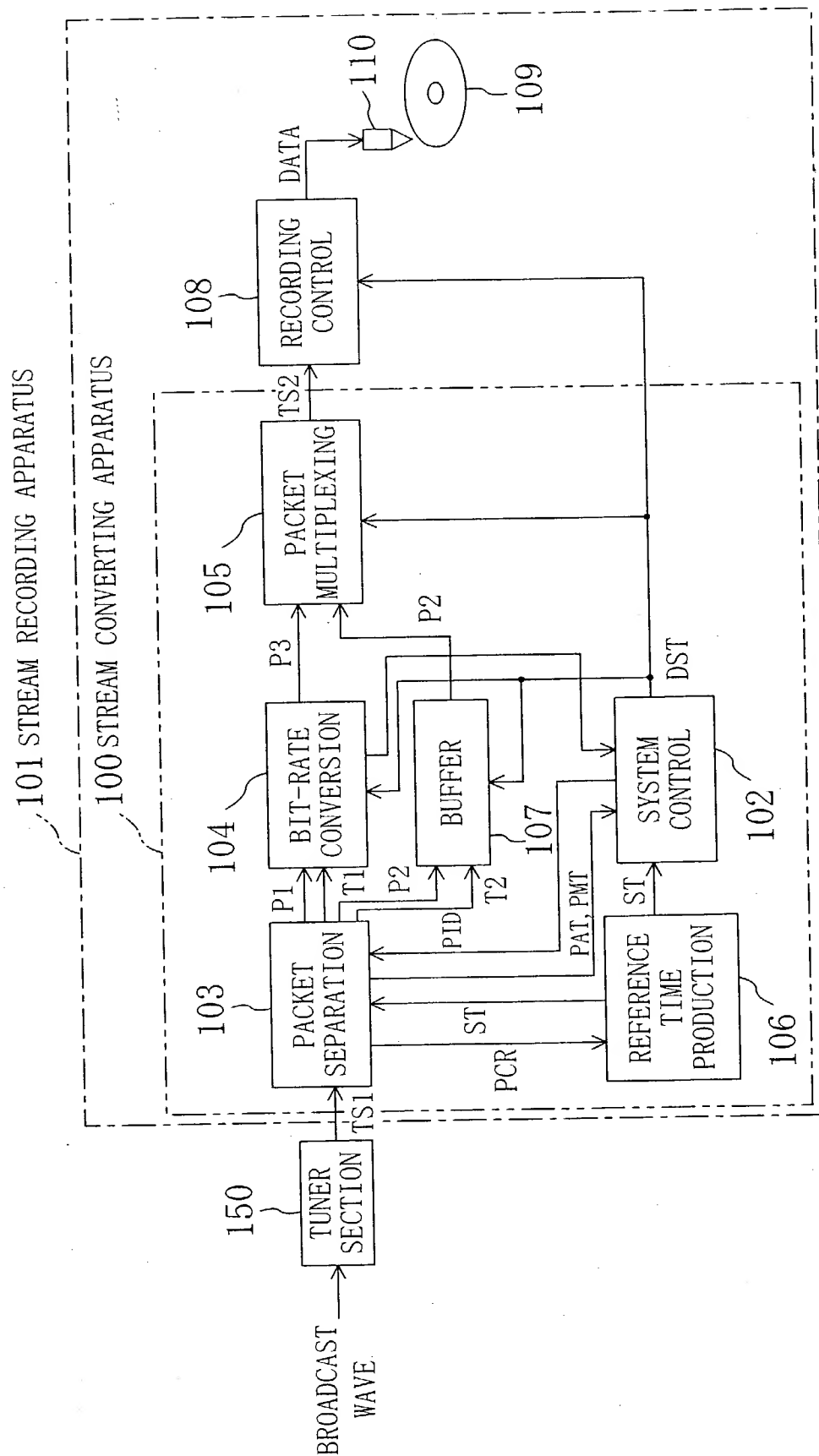
15

ABSTRACT OF THE DISCLOSURE

A packet separating section 103 separates TS packets having a designated PID from a first transport stream TS1 and outputs them as a first TS packet string P1 to a bit-rate converting section 104. On the other hand, the other TS packets are output as a second TS packet string P2 to a buffer section 107. The bit-rate converting section 104 converts the bit rate of the first TS packet string P1 for output as a third TS packet string P3. The third TS packet string P3 is re-multiplexed with the second TS packet string P2 by a packet multiplexing section 105, and recorded onto a recording medium.

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FIG. 1



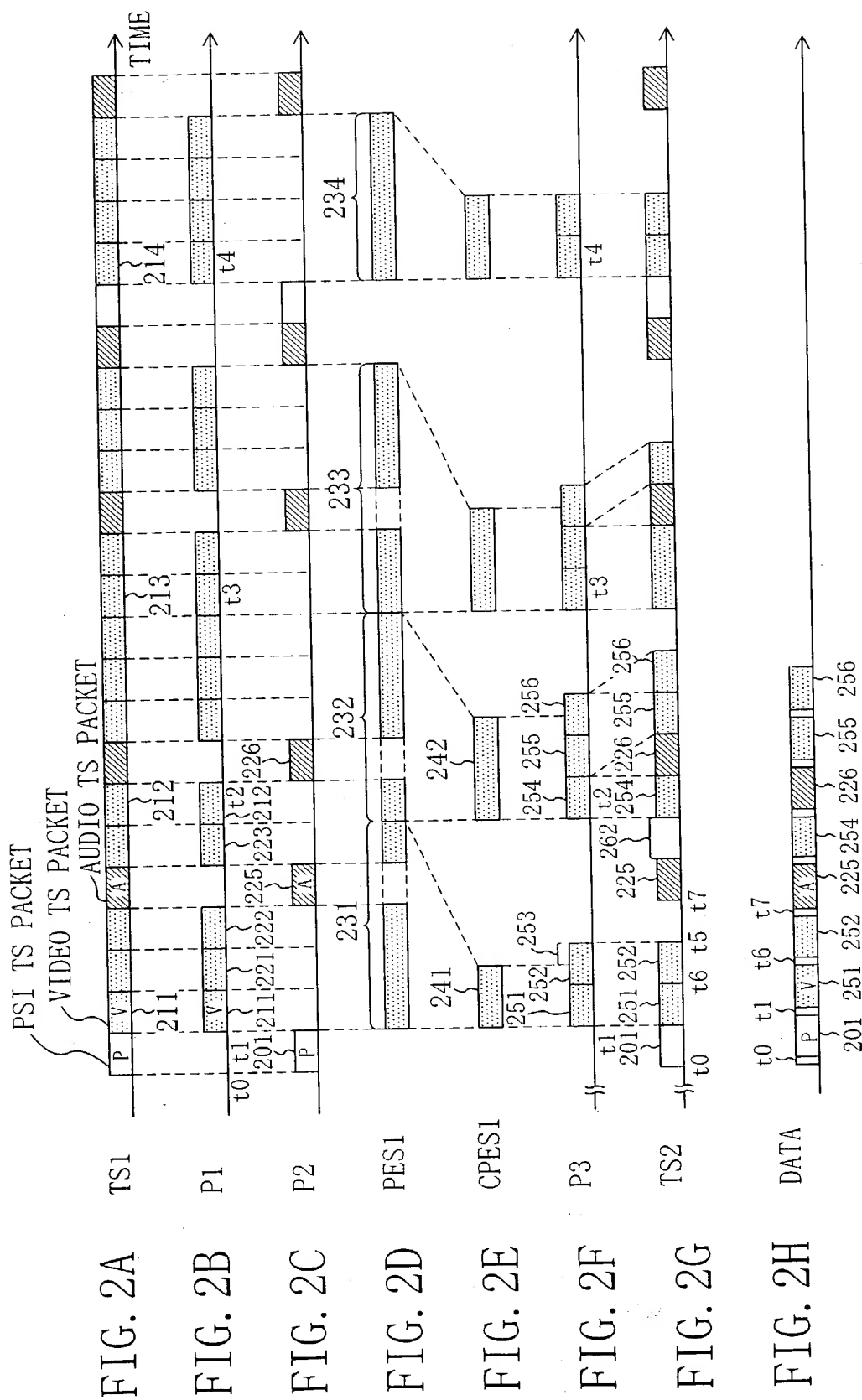


FIG. 3

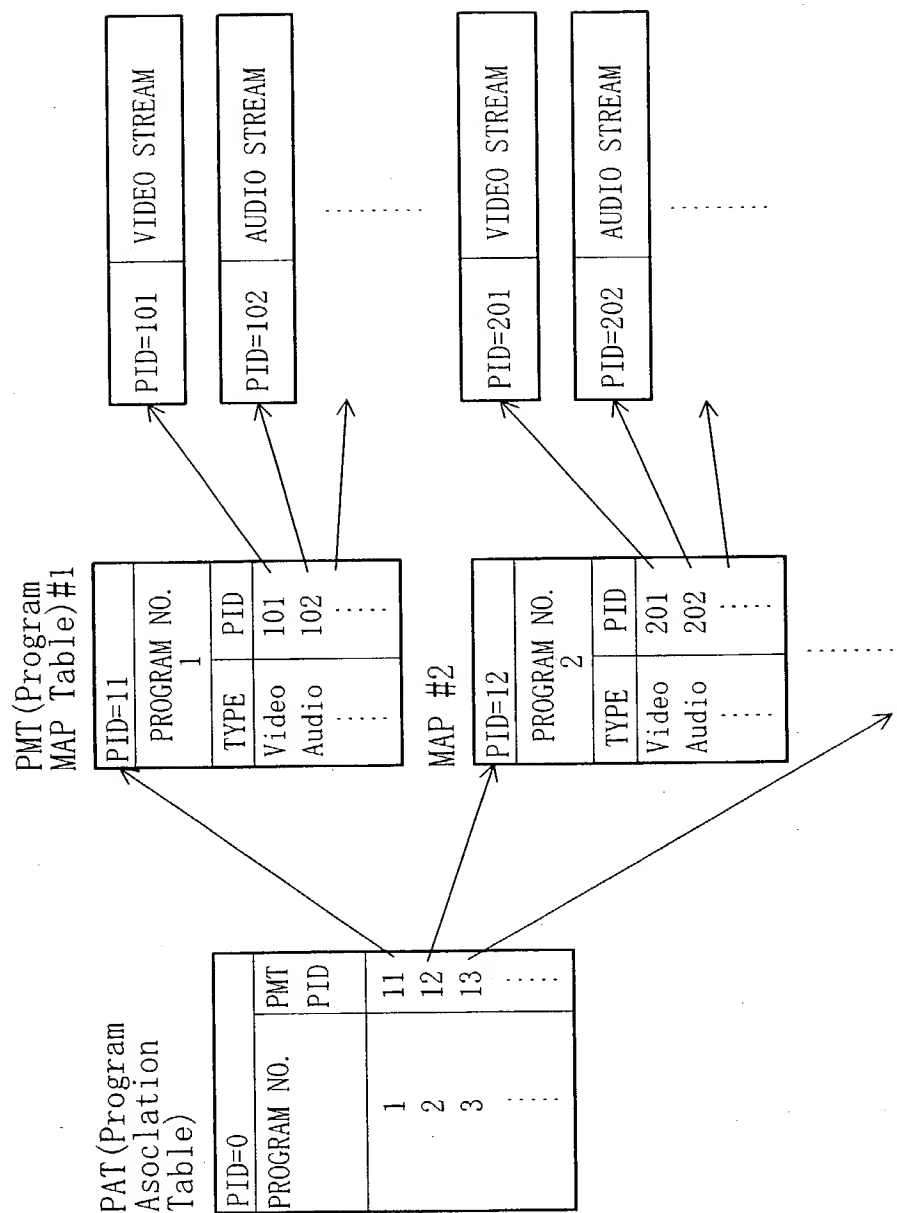


FIG. 4

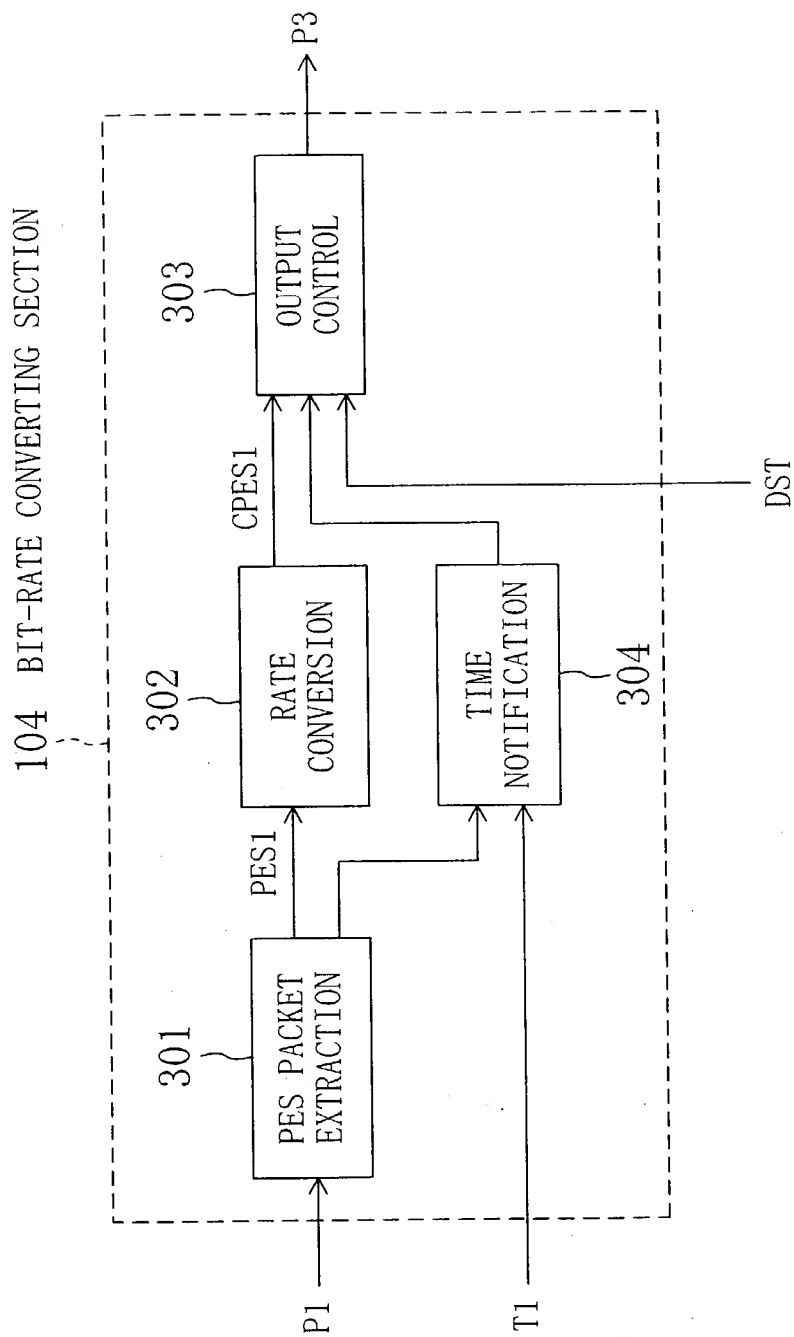
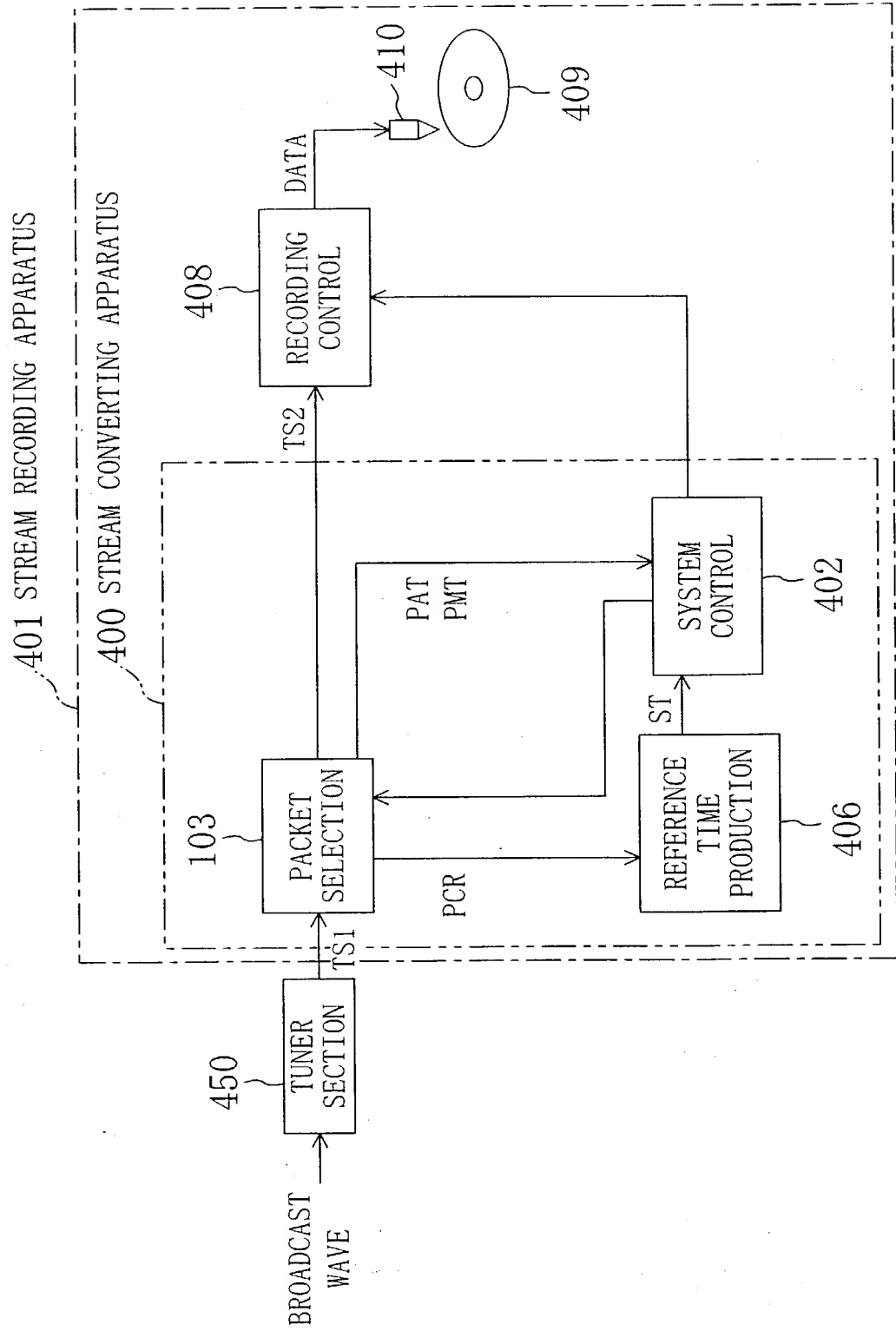


FIG. 5



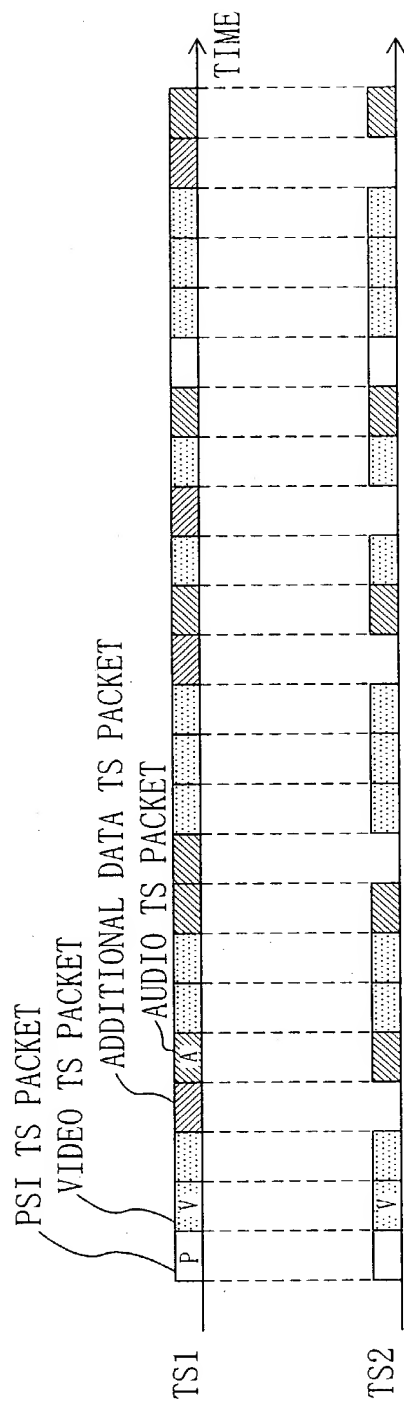


FIG. 6A

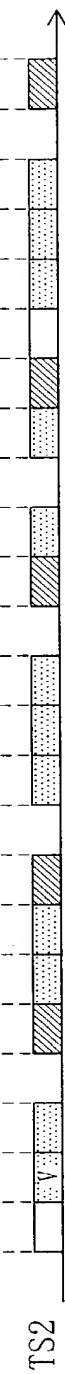


FIG. 6B

FIG. 7A

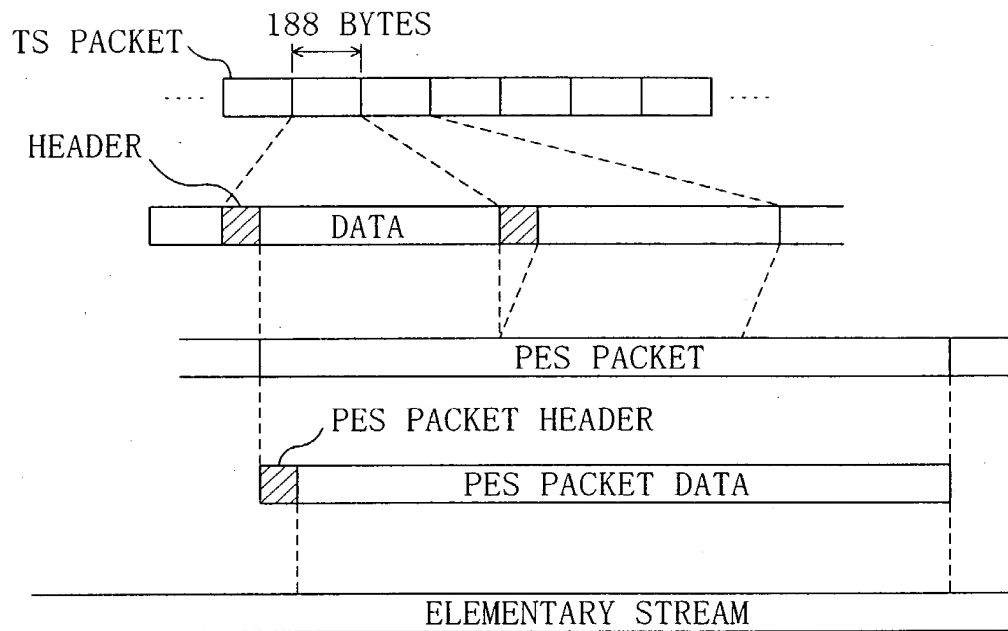
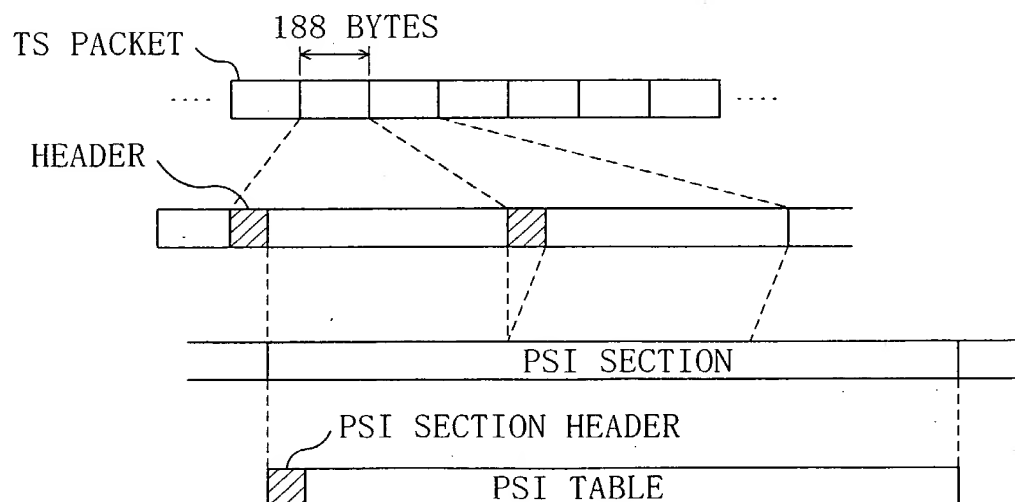


FIG. 7B



COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

(Includes Reference to PCT International Applications)

Attorney Docket No:

As a below named inventor, I hereby declare that:

My residence post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

STREAM CONVERTING METHOD AND APPARATUS THEREOF, AND STREAM RECORDING METHOD AND APPARATUS THEREOF

the specification of which (check only one item below):

☐ is attached hereto.

☒ was filed as United States application

Serial No. 09/830,920

on May 3, 2001

and was amended

on _____ (if applicable).

☒ was filed as PCT international application

Number PCT/IP00/06177

on September 8, 2000

and was amended under PCT Article 19

on _____ (if applicable).

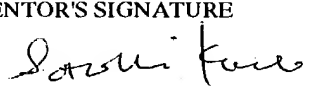
I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations. § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Japan	11-257016	10/09/1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY <small>(Includes Reference to PCT International Applications)</small>				Attorney Docket No:	
I hereby claim the benefit under Title 35, United States Code, § 119(e) or § 120, as applicable of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:					
PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:					
U.S. APPLICATIONS			STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED	
PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			
POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. <i>(List name and registration number)</i>					
Daniel W. Sixbey, (Reg. No. <u>20,932</u>) Charles M. Leedom, Jr. (Reg. No. <u>26,477</u>) David S. Safran (Reg. No. <u>27,997</u>) Donald R. Studebaker (Reg. No. <u>32,815</u>) Tim L. Brackett (Reg. No. <u>36,092</u>) Robert M. Schulman (Reg. No. <u>31,196</u>)		Stuart J. Friedman (Reg. No. <u>24,312</u>) Gerald J. Ferguson, Jr. (Reg. No. <u>23,016</u>) Thomas W. Cole (Reg. No. <u>28,290</u>) Jeffrey L. Costellia (Reg. No. <u>35,483</u>) Eric J. Robinson (Reg. No. <u>38,285</u>) Thomas M. Blasey (Reg. No. <u>33,475</u>)			
Send Correspondence to: Nixon Peabody LLP 8180 Greensboro Drive, Suite 800 McLean, Virginia 22102			Direct Telephone Calls to: <i>(name and telephone number)</i> Eric J. Robinson (703) 790-9110		
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.					
The undersigned hereby authorize any U.S. attorney or agent named herein to accept and follow instructions from <u>Maeda Patent Office</u> as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys or agents named herein will be so notified by the undersigned.					
FULL NAME OF SOLE OR FIRST INVENTOR <u>Satoshi KONDO</u>		INVENTOR'S SIGNATURE 		DATE June 19, 2001	
RESIDENCE (City, State & Country) <u>Kyoto, Japan</u>				CITIZENSHIP <u>Japanese</u>	
POST OFFICE ADDRESS (Complete Address including City, State & Country) <u>7-17, Otokoyama-shigetsu, Yawata-shi, Kyoto 614-8361, Japan</u>					